graphed a female while so engaged, and seen a number of others, especially in the mixed woods of pines and oaks on Long Island, N. Y. Many lay their eggs during the latter part of September on Long Island, and it is then also that the males sing often in the daytime when the sunshine is warmest.

LEGS IN THE CARABIDÆ.

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The coxæ of the anterior and intermediate legs are globular in form and exhibit the same structure throughout the Carabidæ. The apex or upper end of the joint, viewing the beetle as it lies on its back, contains a circular cavity which holds the condyle of the trochanter. Adjoining this cavity on the outer side is another cavity or depression in the outer face of the coxa. This second cavity reaches the outer edge of the joint and is bounded by a more or less carinate edge except at the outer end where the carina is obliterated. Where the two adjoin, the wall of the central cavity is deeply emarginate. This structure gives the leg a greater radius of transverse motion and allows it to be drawn closer to the body in repose.

The anterior and posterior edges of the outer depression are not similar in form. The former, viewed from the front, is straight and continuous with the edge of the central cavity. The latter, viewed from the opposite direction, is strongly concave and elevated in a prominent blunt-pointed tooth where it joins the edge of the central cavity. This tooth is bent slightly over the condyle and strengthens the hold on the latter at the point where the emargination between the cavities tends to weaken it. Considering this to be a description of the anterior coxæ, the arrangement in the intermediate is exactly the reverse; that is, the tooth is on the anterior edge and the posterior edge is straight. When it is considered that the anterior legs are used chiefly to pull the beetle forward and the intermediate to push it in the same direction, the reason for the opposite arrangement is explained and it seems probable that the tooth not only

strengthens the hold on the condyle but also serves as a fulcrum in the motion of leg. The tooth on the intermediate coxæ is not so strong not much more than a distinct angulation.

While the anterior and intermediate coxæ are condyles held by the sternal plates; the posterior are plates, being immovable. The upper surface, which is in the plane of the metasternum, corresponds with the anterior surface of the other pairs; the apex and outer cavity are perpendicular to the plane of the body, and the posterior edge of both cavities is the suture between the coxæ and the first ventral segment.

The upper surface, called the coxal plate, is triangular in form with a rounded posterior apex, covering the base of the trochanter and restricting the hind legs to a forward and back motion like that in the swimming of a frog. The outer portion of the coxal plate conjointly with the under plate forms a point extending to the outer edge of the metasternum between the latter and the first ventral segment.

The coxal or upper plate is flat and extends from the center or near the center of the body to the outer edge of the metasternum. It is widest near the inner edge and tapers rapidly to the outer extremity. In its simplest form as found in *Dyschirius, Clivina* and *Bembidium,* it has an acute edge throughout which is margined on the outer half. It conceals entirely the vertical under plate when viewed from above. In this form the coxæ differ least from the anterior and intermediate pairs. It is also found in *Opisthius, Leistus, Promecognathus,* the Pogonini, four species of *Platynus—larvalis, caudatus, dissectus* and *pusillus,* in *Leptotrachelus, Casnonia ludoviciana* and *Zacotus.*

In most species of Carabidæ the upper plate is narrower externally and the under plate wider and oblique so that the latter is visible from above. In *Cychrus, Carabus, Calosoma, Galerita, Cymindis, Helluomorpha* and *Brachynus* the plates, which are of this type are separated by an entire carina. In general, however, the carina is lacking on the outer half of the coxæ and the plates are separated by a groove, the marginal groove of the upper plate. This groove also is lacking on the outer fourth or third in *Anomoglossus, Brachylobus,* and *Lachnocrepis.* In the remaining genera, including the three last named and a few species of *Cychrus—heros, elevatus, bi-*

carinatus, lecontei, and *Carabus—vinctus* and *limbatus,* the outer part of the coxæ is also flattened in part or wholly to the plane of the metasternum and ventral segments; sometimes only the extreme outer point as in the species of *Cychrus* and *Carabus* mentioned and most of *Pterostichus,* or a half of the outward extension as in the subgenus *Pœcilus* of the genus *Pterostichus,* in the subgenera *Amara* and *Celia* of the genus *Amara,* in the genera *Loxandrus, Diplochila* and *Dicælus*; or the whole of the extension as in *Chlænius.*

In general when the extension is flat, the outer part of the upper plate is very narrow, the dividing groove then being close to the metasternal suture. The extreme examples are found in the genera *Callida, Euproctus, Pinacodera* and *Onota,* in which the extension consists almost entirely of the lower plate. In these genera and *Chlænius,* therefore, is found the greatest dissimilarity in structure and function between the two front pairs and the posterior pair of coxæ.

Casnonia pennsylvanica and *Casnonia ludoviciana* show the greatest dissimilarity in the structure of the posterior coxæ to be found in two closely related species. In the former the under plate is very oblique and slightly flattened at the outer end, in the latter the under plate is vertical and invisible from above.

In the genus *Plochionus* the groove on the coxal extension is very close to the anterior margin near the middle of the coxa, but curves away from the margin at its outer extremity. This character is also found in a greater degree in the genus *Oödes.* In *Oödes amaroides, americanus* and *fluvialis* the groove resembles that found in *Plochionus.* In *Oödes elegans* the groove is sinuate; in *cuprœus* the groove is in the form of a semicircle in its outer half; in *quatuordecimstriatus* the semicircle occupies the whole of the coxal extension. No known coxal structure could be represented by this groove, which, therefore, seems to have lost its character as an indicator of structure and become merely sculptural ornamentation, a fact which denotes a remote ancestry for the genus.

The trochanters of the anterior and intermediate legs like the coxæ are, with one known exception, invariable in form. They are short, connate with the femur and joined obliquely with it, their lower edge being prolonged. The apices are supported by short prominences in the basal edge of the femur. The joint is nearly rigid.

In the posterior trochanters the prolongation is much greater and free from the femur at its apical end. In *Omophron* and the Cychrini it is short, about one fifth the length of the femur, oval in form, with a strongly rounded end. In the remaining Carabinæ, excepting the Scaritini, it varies from two sevenths to one third. In the Scaritini it is larger. In *Ardistomis* only is it as small as one third. In the other genera it varies from three sevenths to one half the length of the femur. In *Scarites* the apex is acute.

In the Harpalinæ bisetosæ it varies from one fifth in *Platynus caudatus* to four fifths in the male of *Patrobus californicus,* in which species it is very acutely pointed. It is also acutely pointed in *Patrobus aterrimus.* Elsewhere in the subfamily it varies from one quarter to one third. In *Oödes americanus,* however, it is three sevenths the length of the femur. In the Harpalinæ unisetosæ the trochanters are longer, three sevenths to one half in the majority.

The femora vary in size and shape, not only among the species but also in the three pairs of an individual, for the anterior femora are the shortest and stoutest and the posterior the longest and most slender. This difference in the three pairs is always distinct but is less in such narrow elongate species as *Pterostichus angustus* or *Zacotus matthewsii.* In the Cychrini, excepting the genus *Sphæroderus,* the legs are very slender and even in thickness. Elsewhere the posterior femora are not only more slender but also more clavate in form.

In a large proportion of the species the femora are grooved for the reception of the tibiæ when drawn in to the body. The grooves are always strongest at the apical end and are often confined to the apical one third or one half. The natural expectation would be to find the grooves strongest in those species with short, stout legs. This is not always the case, however. In *Promecognathus* the anterior femora are stout and ungrooved; in *Pasimachus* the anterior femora are very stout and the grooves are very faint; on the other hand, in the closely allied genus *Scarites* the grooves are strong. In the slender legged genus *Nebria* the species *ovipennis, metallica* and their allies have the femora strongly grooved, but in the species *pallipes, sahlbergi* and their allies, the femora are ungrooved. In *Pterostichus* the femora are stout and strongly grooved; in *Amara* the femora are somewhat less stout but no less strongly grooved.

In *Amara obesa* the anterior edge of the grooves on the anterior femora is sharply carinate from the apex for about four fifths the length of the joint; the posterior for one quarter only. In *Badister pulchellus* the anterior carina is still stronger and entire, ending on the center line of the joint. Unequal carination of the edge of the grooves is also found in *Loxandrus* and *Diplochila.* In the males of *Chlænius laticollis* the anterior carinæ of the anterior femora end in a prominent acute tooth at less than one quarter from the base. The tooth is on the center line of the joint. The posterior carinæ vanish a short distance in front of the tooth. In the males of *Chlænius prasinus* the edges of the grooves are not carinate; there is, however, a short, obtuse tooth, whose apex is carinate at about one third from the base. This tooth is not on the center line but anterior to it, on the edge of an evenly outlined groove. In *Chlænius ruficauda,* also, the edges of the grooves are not carinate. In the males of this species there is a short, acute tooth at one fourth from the base, situated as in *prasinus.* In *Nebria ovipennis* both edges of the anterior femoral grooves are carinate and unite in a distinct point at about one fourth from the base; in the closely allied *Nebria gebleri* both edges of the grooves are strongly carinate and entire to the basal margin, where they do not unite. In *Pachyteles testaceus,* a small species placed in the tribe Nomiini, there is a large, very acute tooth on the anterior edge of the femoral groove, about two fifths from the apex. Between the tooth and the apex the edge is not carinate. There is a strong carina, however, from the tooth to the base of the joint, which is continuous with the strongly compresso-carinate trochanter, the only instance known of a modification in the form of the latter.

The most important structural modification in the form of the tibiæ is found in the interior groove of the anterior pair. In the Cychrini there is a long straight groove on the interior face, evanescent toward the base and widest and deepest at the apical margin between the two spurs. In *Nebria sahlbergi, Leistus ferrugineus* or *Calosoma calidum,* the groove is not straight, but curved apically against the posterior spur, which is slightly higher on the tibia than the other spur. The curve in the groove is still more pronounced in the genus *Blethisa,* and the groove instead of terminating on the apical margin of the tibia as in *Cychrus,* terminates in the lateral

margin, producing an emargination therein. In these genera and all the genera in which this emargination is strong, the posterior spur is found some distance above the apex: in *Thalpius pygmæus* near the middle; in *Dyschirius tridentatus* nearer the base than the apex. In the remarkable genus *Metrius,* however, the posterior spur is terminal, although the groove is curved into the lateral margin and produces an emargination therein; and on the other hand, in *Omophron,* although the groove is straight as in the Cychrini, the posterior spur occupies a strongly ante-apical position. In *Pasimachus* the groove is replaced by a hemispherical excavation, which cuts the lateral margin close to the apex, between the base of the tarsi and the posterior spur, which is slightly ante-apical. In *Scarites* the excavation becomes an oblique transverse groove cutting both lateral margins of the joint. In this form it is found throughout the subfamily Harpalinæ.

The tibiæ are always thicker at the apex than at the base; sometimes only slightly so as in *Omophron* or *Brachynus*; sometimes suddenly thicker at the apex as in the Scaritini, the genus *Pterostichus,* or the Dapti. The anterior pair are always thicker and shorter than the posterior.

Although the anterior pair are often strikingly modified with teeth and apical prolongations, as in the Scaritini and Dapti, the intermediate tibiæ in the majority of the genera are the most strongly modified with secondary sculptural ornamentation in the form of grooves, carinæ and spines.

In the intermediate and posterior tibiæ, some traces of a row of spines on each side, often accompanied by a distinct carination, is always found, excepting possibly in *Casnonia, Zuphium, Thalpius, Ega* and *Brachynus.* On the exterior faces of these tibiæ is rarely found a simple longitudinal groove, stronger on the intermediate, as in *Leistus ferrugineus.* In *Nebria ovipennis* and *metallica* this groove is found on the intermediate tibiæ only, and is open at the apex. In *Platynus reflexus* a weak groove is found on the intermediate tibiæ only; it is placed near the middle; in the closely related *Platynus brunneomarginatus* intermediate and posterior tibiæ are both grooved, the groove extending nearly to the apex. In *Callida viridipennis* there are weak grooves near the apex on both pairs of tibiæ. The grooves are most strongly developed in *Platynus funebris.*

In place of the grooves, the intermediate and posterior tibiæ may have a central longitudinal carina as in *Galerita decipiens* and in *Badister pulchellus*; in which case, the crest usually carries a row of coarse punctures bearing spinules. In *Lebia grandis* the exterior faces are compresso-carinate and the crest carries such a series. In *Helluomorpha bicolor* the whole tibia is compressed and the narrow external edge is sharply and deeply grooved. These grooves are open at the apex. The carinate edges are spinulose-punctate, more strongly in the intermediate pair. In the intermediate pair the punctures are exactly on the crest; in the posterior pair they are more on the outer side of the carinæ. In *Philophuga viridicollis* both pairs of tibiæ are grooved, but the limiting carinæ are indistinct and the grooves are not open behind. The row of punctures on both pairs in this species are slightly off the crests. In *Tetragonoderus fasciatus* a row of spine-bearing punctures is found in an anterior position on the intermediate tibiæ, though no groove is present. The corresponding posterior row is less numerous or entirely absent. In *Pterostichus stygicus, coracinus* and *mœstus* there is a row of three or four large punctures on the apical third of the intermediate tibiæ. These are not on the center line but slightly anterior in position.

The antero-exterior apical margin of the intermediate tibiæ in *Harpalus, Chlœnius, Calosoma* or *Cychrus* bears a fringe of close-set spinules. In a male *Platynus angustatus* or a male *Pterostichus ater* this fringe is strongly arcuate, concave to the margin. The fringe does not mark an emargination, however, for the apex is entire beneath the fringe. In a male of *Pterostichus lucublandus* the feature is most strongly developed. In that species it is further removed from the apex, straight and free at both ends. In the males of the subgenus *Cyrtonotus* of the genus *Amara* the interior face of the intermediate tibiæ is dentate or bisinuate; in the males of the genus *Discoderus* the tibiæ are strongly arcuate and denticulate within.

The tarsi in the Carabidæ are five-jointed and the last joint bears two claws at its apex. The first joint is always the longest, but in the Harpalinæ unisetosæ the difference between the first and second joints is sometimes not very great. In *Onota floridana,* on the other hand, the first joint of the posterior is equal in length to the next four. The tarsi of the posterior legs are always the longest and

those of the anterior the shortest. In the majority of the species the first joint is equal in length to the next two or three. The first is always wider at the base than the others. The joints of the anterior tarsi are more or less flattened and triangular in form and the joints of the posterior more or less cylindrical, excepting the tribe Dapti and the genus *Agonoderus*.

The fourth joint throughout the family is rarely more than slightly longer than wide, even in such long-legged species as *Scaphinotus angusticollis, Platynus caudatus* or *Platynus angustatus*. The genera *Lachnocrepis* and *Oödes* are exceptions. The legs in these genera are only moderately long, yet the fourth joint is distinctly elongate. In the subfamily Carabinæ, except in the genus *Promecognathus* and the Harpalid genera *Nomius, Psydrus, Morio, Bembidium, Tachys* and *Trechus*, the fourth tarsal joint is not emarginate at apex. In the remaining genera the fourth joint at least is always more or less emarginate. In *Agonoderus* the fourth joint of the anterior tarsi only is emarginate, but usually the fourth joint of the posterior tarsi is not perceptibly less emarginate than that of the anterior.

In the males of the genus *Pterostichus* the first joint of the anterior tarsi is nearly as strongly emarginate as the fourth and the third is the least strongly emarginate. Elsewhere the third joint is sometimes very slightly emarginate in addition to the fourth, but the second and first are always truncate. In many genera of the Lebiini and the genus *Stenolophus* the fourth joint is bilobed; in *Stenolophus* only in the anterior and intermediate legs.

In the males of most of the genera of the family, the anterior tarsi have one or more dilated joints bearing squamulose hairs beneath. In *Omophron* the first joint only is dilated. In *Bembidium* and *Tachys* the first two joints are dilated. In most of the genera the first three joints are dilated. In *Tachycellus* the first dilated joint is slightly narrower than the second; in *Anisodactylus* it is still narrower; in the other genera the first is equal in width to or wider than the second joint. In the tribe Dapti and the genus *Agonoderus* the anterior tarsi are similar in both sexes. In the Cychrini, omitting the genus *Sphæroderus*, and in the genus *Platynus* the anterior tarsal joints of the male are very slightly dilated.

In the genera *Bembidium, Tachys* and *Loxandrus* the inner angles

of two or three of the dilated basal joints are toothed or prolonged. In these species the squamules beneath are arranged symmetrically with the axis of the leg. In *Galerita* the angles are similarly prolonged and the two series of squamules beneath are directed toward the prolonged angle. The structure is similar in *Lebia grandis,* but in *Lebia pulchella* and *furcata* the joints are symmetrical, yet in these species also the double series of squamules is directed toward the inner angles of the joints.

Although the intermediate tibiæ are more strongly sculptured than the posterior, yet the reverse is the case in the tarsi. The sculpture of the tarsi, which is found in a few genera only, consists of longitudinal grooves, sometimes with an intervening carina. These are most highly developed in *Platynus funebris,* in which all the tarsal joints on the three pairs of legs are strongly grooved. Usually the anterior tarsi are ungrooved. In *Pterostichus lucublandus* all the tarsal joints of the posterior legs are grooved, but only the first three on the intermediate legs. In *Pterostichus mœstus* or *patruelis* the first three joints of the posterior tarsi are grooved and the first two of the intermediate. However, when only the first or the first and second joints of the posterior tarsi are grooved, the same are grooved on the intermediate. In *Pterostichus coracinus* the first two joints are grooved on both pairs; in *Amara subœnea* the first one only.

The anterior trochanter and femur have setæ bearing punctures on them which are often arranged in a distinct order. The trochanter invariably carries one seta on the under side near the femoral joint. The setæ on the femur are usually disposed in longitudinal rows, often more or less irregular or indistinct. They are most strongly developed in the genus *Calosoma.* In that genus there is a longitudinal row of setæ-bearing punctures on the anterior and posterior faces a little below the middle. The rows are about equal in numbers, varying from nine to twenty-nine. The row on the posterior face is continuous. It starts at the basal edge of the femur. The row on the anterior face is interrupted at about the basal one fourth. The punctures between the break and the basal edge are usually four or five in number and are arranged in an irregular group. An irregular group is rarely found on the other side of the break at the basal end of the row. In *Pasimachus* there is an irregular group of about six punctures on the anterior face

near the apex; on the posterior face there are one or two large punctures very close to the basal edge. These latter punctures are found in *Scarites, Dyschirius, Clivina* and *Aspidoglossa.* In *Anisodactylus piceus* there is an irregular group of eight to ten punctures near the apex on the anterior face. In other species of *Anisodactylus* there is a more or less distinct transverse row of three to four in this position. In *Cratacanthus* the row is more distinct.

In *Clivina, Aspidoglossa* and *Schizogenius* there is one large puncture at the middle of the posterior face.

In most of the genera the punctures of the posterior face are the more distinct. They are one at about the basal fourth at or below the middle; one at the middle at or near the lower edge; one at the apical fourth at or above the middle.

In *Calathus* and a number of genera in the Lebiini the tarsal claws are pectinate or serrate and in *Schizogenius* there is an appendage between the claws which may be comparable to similar appendages in other orders of insects.

The anterior or terminal spurs of the anterior tibiæ exhibit modifications in form in a number of the genera. They are slender and frequently straight in *Bembidium,* but elsewhere are more often thickened at base with a curved acuminate apex. In *Oödes cupræus* or *elegans* the apex is strongly curved. In some species of *Anisodactylus* and *Amara* the spurs are trifid; in other species of *Anisodactylus* they are dilated at base; and in others they are simple, moderately slender and nearly straight. In the Lebiini the spurs in the genera *Cymindis* and *Apēnes* are moderately large; in *Tetragonoderus* and *Nemotarsus* they are long and slender; in the other genera they are very small and straight. They are also straight and slender in *Brachynus.*

MISCELLANEOUS NOTES.

Necrophorus Guttula Motsch and its color Varieties.—In his "Monograph of the North American Silphidæ," published in Trans. American Entomo, Soc., Vol. VIII, October, 1880, page 232, Dr. George Horn says regarding *Necrophorus guttula* Motsch, "The color of the elytra is extremely variable in this species, in the typical